# Geo-engineering climate solutions come with great risk

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## Body

Desperate times bring desperate measures. We know this when the seriousness of our predicament has scientists considering geo-engineering technologies to help mitigate climate change.

Greenhouse gas levels are now at 415 parts per million, well above the considered safe level of 350, and climbing at 3 p.p.m. annually. As climate change continues unabated, in lockstep with rising emissions, our mitigation options for avoiding the worst consequences of climate change are shrinking.

We are backing ourselves into a corner and have to hope the movers and shakers come to their senses in time, as we all must. If not, we are left with unproven and possibly dangerous "Hail Mary" geo-engineering technologies that could well backfire.

"Geo-engineering is the deliberate large-scale intervention in the Earth's natural systems to counteract climate change." Ironically, for over 150 years, we have deliberately been conducting " a large-scale intervention ...", an uncontrolled experiment on the Earth by pumping enormous quantities of greenhouse gases into the atmosphere, creating many of the climate-change problems we are now trying to fix. Can we now somehow reverse engineer these changes?

Unless we can put the brakes on climate change, we may have little choice. We don't have the benefit of time, yet we continue to fritter it away with indecision and a lack of will.

A real concern is that too much reliance on these doomsday "solutions" further distracts us from the higher priority of urgently cutting carbon emissions.

These technologies, some of which border on science fiction, include solar reflection, mimicking what happens when erupting volcanoes, such as Mt. Pinatubo, eject huge quantities of particulates into the stratosphere, blocking solar radiation and temporarily reducing the Earth's temperature.

However, "the combined effect of greenhouse gases and solar engineering could create a real mess - potentially destabilizing weather and climate patterns in unforeseen ways."

A second technology is carbon removal, but "there are limited options for large-scale carbon removal. These include direct air capture, the use of various minerals that bind with CO2, reforestation efforts, and what's known as bioenergy with carbon capture and storage (using crops as fuel but capturing any emissions released when they're combusted).

None of these options can be easily scaled up. Direct air capture is still prohibitively expensive and energy intensive. Using crops for fuel means snatching land from other uses, such as growing food for a swelling population."

There are several ocean-based CO2 removal strategies, each with their challenges. One of the more controversial ones uses iron dust as fertilizer to create algal blooms to absorb CO2 from the atmosphere. This strategy also comes with a whole list of potentially harmful side effects.

In relying on carbon removal, nations and companies are simply moving the goalposts, ignoring their responsibility to reduce their carbon emissions in a meaningful way.

More experimentation and data is needed to better understand the consequences of what would essentially be yet another, perhaps more damaging, experiment on the Earth's atmosphere, with the planetwide use of these technologies.

Is it human nature to seek simple solutions to complex, difficult problems? There are no easy solutions to our climate change crisis. It is disingenuous to think otherwise.

What we need is everyone on the same page and working together, seemingly impossible in our chaotic world with societal divisions, political turmoil and war.

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